

## DETAILS OF THE WEATHER IN THE UNITED STATES

## GENERAL CONDITIONS

The single outstanding feature of the month was the sharply contrasted distribution of temperature and precipitation in the various sections of the country.

These contrasts are traceable to the prevalence of two different types of pressure distribution; the first, which prevailed until about the 20th, favored the free movement of cyclonic systems along the average path; the second was practically the reverse, since anticyclones that originated in the North Pacific and Alaska progressed almost in a due-east direction over Canada and the northern part of the United States rather than from northwest to southeast. Pressure in the North Pacific HIGH was somewhat below the normal.—A. J. H.

## CYCLONES AND ANTICYCLONES

By W. P. DAY

With the exception of a small tropical disturbance, which caused moderately high winds and heavy rain over the lower Rio Grande on the night of the 6th-7th, low-pressure areas were generally ill defined and of slight barometric gradient until the 19th, when a rather important storm area developed over the northern Rocky Mountain region and moved eastward. High-pressure areas were likewise unimportant until the last decade. Near the beginning of this period pressure began rising over the Aleutian Islands. This HIGH developed and spread eastward over the Gulf of Alaska and into the interior of Alaska and then into Canada and by the end of the month a great area of high pressure covered much of Canada, Alaska, and the northern portion of the United States. Due, however, to the oceanic origin of this HIGH there was no important depression of temperature associated with it.

## FREE AIR SUMMARY

By V. E. JAKL

The principal feature of upper-air temperature averages for the month was a general well-pronounced excess at all stations as compared with the normal. (See Table 1.) It was most pronounced over Due West, and showed no well-defined variation with altitude; therefore the surface departures, as shown in Chart III of this REVIEW, fairly well represent the distribution of the free-air departures also. Notwithstanding this general excess in temperature, relative humidities averaged about normal, indicating a generally greater moisture content of the air than is usual for the time of year.

Resultant free-air winds were, with few exceptions, southwesterly, becoming westerly at 4,000 meters and above. The principal exception was at Key West, where winds were practically due east at all levels observed. Easterly winds aloft were of infrequent occurrence over mid-continental stations, although they were persistent over the southern Plains States during the first few days of the month, of which good examples are shown in the kite and pilot balloon observations at Groesbeck on the 1st, and the two-theodolite pilot balloon observation at Broken Arrow on the 2d. In the former observation, nearly due-east winds were recorded from the ground to about 7,000 meters, and in the latter, southerly winds in the lower levels backed to easterly at 8,000 meters, remaining due east thence to 12,000 meters.

Weak high pressure covered the greater portion of the country during this period. The principal instance of easterly wind to high altitudes over northern stations occurred at Ellendale on the 22d, when a two-theodolite observation showed westerly winds near the ground, veering with altitude and becoming northeasterly from 6,000 to 9,000 meters. On this date a ridge of moderately high pressure overlay the northern portion of the country, Ellendale lying along its northern border.

Comparing the resultant winds with the normal, it is found that the deviations were on the whole slight (see Table 2), being apparent principally at Groesbeck, where the resultants showed south-southwest at all altitudes, as compared with slightly east of south for normal. Wind resultants from kite observations at Due West are based on too few observations to be reliable, but balloon observations at that station showed more definitely that the winds were principally northwesterly at all altitudes, except that in the lowest 500 meters the wind changed from prevailing northeasterly in the morning to northwesterly in the afternoon. The abnormally high temperatures at Due West were therefore associated with winds of continental (presumably near by) origin both at the surface and aloft. This is particularly shown in connection with the maximum temperature for the month, 105° on the 8th, which was accompanied by light northwesterly winds to 4,000 meters, becoming westerly at 5,000 meters.

The following record of the upper-air observation at Ellendale on the 4th, and comments of the official in charge relative thereto, is descriptive of the conditions attending a kite flight made immediately preceding a thunderstorm of the "wind shift line" type. The stratus approaching from the northwest when the winds aloft were still from directions ranging from east to south with altitude, apparently represented the top of the turbulent column of the approaching "cold front."

Surface wind became northwest soon after the flight.

"During the latter half of the flight of the 4th severe thunderstorm conditions developed. Storms were located to the south and northwest of the station. The storm to the northwest seemed to develop very rapidly. Wind directions aloft shifted from south to east within the range of altitude from 1,500 meters down to the ground. A thin line of stratus clouds was observed to be moving from the northwest before landing the head kite. When close enough to be more carefully observed it was noted that a violent rolling motion was present. A maximum surface wind of 58 miles an hour from the northwest was recorded at 2:18 p. m., with a light but rapid fall of rain."

Time, p. m.	Altitude, m. s. l.	Temper- atures	$\Delta t$ 100 m.	Relative humidity	Wind direction	Wind velocity
	<i>Meters</i>	<i>° C.</i>		<i>Per cent</i>		
12:43	4,941	-5.0	0.41	49	S.	15
12:55	4,573	-3.5	.34	92	S.	14
1:00	4,515	-3.3	.62	74	S.	14
1:04	4,283	-1.9	.77	94	S.	13
1:33	3,073	7.4	.71	80	S.	15
1:40	1,951	15.4	.96	53	S.	16
1:52	1,152	23.1	.75	45	ESE.	14
2:01	1,444	28.4	-----	48	ESE.	5

1 Surface.

The following record of the kite flight at Groesbeck on the 24th, including an excerpt from the report of the official in charge, shows upper-air conditions at that sta-